Manitoba Hydro

Available Transfer Capability Implementation Document (ATCID)

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Version/Review Control:

Version	Date	Signing Authority	Brief Description of Change/Review
1.0	April 1, 2011	M.D. Rheault, L. A. St Hilaire	Documentation of current practices.
2.0	May 16, 2011	M.D. Rheault, L.A. St Hilaire	Added reference to Seams Operating Agreement to section 6.4 and posting on OASIS of ATCID in section 7. Minor typographical corrections.

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1 Introduction

Manitoba Hydro has elected to use the MOD-028 methodology, The Area Interchange Methodology, to define Available Transfer Capability. This document is the Available Transfer Capability Implementation Document (ATCID).

2 Modeling Data

2.1 Seasonal Planning Horizon

Manitoba Hydro uses the Northern MAPP Operating Review Working Group (NMORWG) package to perform TTC calculations for the Manitoba-US and the Manitoba-Ontario interfaces. This package contains the latest modeling data, topology and facility ratings of the Northern MAPP area and surrounding area critical to the reliability of the Northern MAPP area available prior to the start of the season. Manitoba Hydro develops cases with SaskPower Corporation based on the latest MRO cases available that contain the latest modeling data, topology and facility ratings of the MRO region to perform TTC calculations on the Manitoba – Saskatchewan interface.

2.2 Operations Planning

Manitoba Hydro Electric Board (MHEB) has contracted out the administration of the Open Access Transmission Tariff (OATT) to the Midwest ISO (MISO). The Midwest ISO calculates the ATC for each of the Manitoba Hydro interfaces and posts the available short term ATC for the each of the Manitoba Hydro interfaces on the Manitoba Hydro OASIS site called the "Manitoba Hydro Interface ATC Tool". In order for MISO to perform the ATC calculations, Manitoba provides inputs to MISO for TTC and TRM calculations hourly for the first seven (7) days, daily ATC for days 8 through 31 and monthly ATC for months 2 through 36. The inputs to MISO's Manitoba ATC Webtool include the TTC and TRM from the MHEB TLAP tables, and the Non-Firm Coefficient.

The ATC Webtool runs 10 minutes past the hour and takes around 5 minutes for the ATC calculator to pick up and calculate the ATC values. The ATC calculator runs 16 minutes past the hour and finishes by 23 minutes past the hour. The TTC/TRM values are calculated and update the ATC Webtool according to the following schedules:

- Every night at 00:16 - the full file is sent with all hourly, daily & monthly values
- Every 4 hours thereafter at xx:16 - all hourly values for next 7 days
- Every hourly at xx:16 - only the changed values within that hour

The ATC tool is located on the MISO OASIS under the System & Information studies page. MISO's obligation to calculate ATC is reflected in the Seams Operating Agreement.

TLAP tables: The TTC and TRM for system intact and the system outage condition values based upon the seasonal studies. The TLAP tables are updated prior to the start of the summer and winter operating seasons (summer - May 1st to October 31st, winter – November 1st to April 30th)

Non-Firm Coefficient: The non-firm coefficient number is used to calculate the releasable TRM. It is ratio of the system outage condition TRM to the System intact TRM. The coefficient is calculated every hour and extends up to 36 months into the future. It is abbreviated COEF in this document.

2.3 Real-Time Data

Manitoba Hydro provides all the data requested by the Midwest ISO through ICCP, ftp, and other processes used by MISO within the timelines in the Seams Operating Agreement.

3 Source and Sink information

3.1 Study Horizon

In the study horizon, transactions cannot be sourced or sunk at the border. As such, for transactions between Manitoba and:

- The US: generation at Dorsey is manipulated, and generation/load in the MAPP or eastern system is manipulated to facilitate transfers.
- Ontario: generation at Dorsey is manipulated, and generation/load in the western Ontario system is manipulated to facilitate transfers.
- Saskatchewan: generation from the US swing bus (which is representative of generation at Dorsey) is traded for generation at Nipawain and EB Campbell (Saskatchewan) to facilitate transfers.

3.2 Transaction Horizon

The Manitoba Hydro Open Access Transmission Tariff applies to all transmission service requests within the province of Manitoba. Transactions are represented from Manitoba to the international border.

Manitoba Hydro sources and sinks have a single Point Of Delivery (POD) and a single Point Of Receipt (POR). When making a transmission service reservation involving Manitoba Hydro transmission service the following POD/PORs are used:

Table 1: POD/POR used for Manitoba Transmission Service Reservations

POD/POR Name	POD/POR Type	Model Mapping
MHEB	POD/POR	Dorsey Generation
MHEB.IMO	POD/POR	The Manitoba Ontario Border
MHEB.MAPP	POD/POR	The Manitoba US Border for MAPP transactions
MHEB.MISO	POD/POR	The Manitoba US Border for MISO transactions
MHEB.SPC	POR	Island Falls Generation
SPC	POD/POR	3-230 kV interconnections to Saskatchewan at the Manitoba Saskatchewan border
SPC_SEP_LOAD	POD	For MH serving Saskatchewan Separated Load

Refer to Manitoba Hydro Open Access Transmission Tariff, Section 13.7 (b), for treatment of generation grouping in ATC calculations.

4 Calculation of Total Transfer Capability (TTC)

Manitoba Hydro performs seasonal studies to establish the TTC for its three interfaces. Seasonal studies use the models described in 2.1. These studies identify the transfer capability for each ATC path respecting the system operating limits in the source and sink networks.
All interface guides are sent to the Midwest ISO Reliability Coordinator. The MISO RC will post the guides on the MISO RA web page
http://extranet.midwestiso.org/operations/Active_OpsGuide.php

(Note – Login and password required for viewing)

Manitoba Hydro technical studies, as detailed in subsequent sections, are used to develop TLAP tables that document the transfer capability (TTC and ATC) for all interfaces. The TLAP tables are used for both the operational planning and real time horizons. Therefore, the assumptions used to calculate TTC and ATC values are also the same in all time horizons. Manitoba Hydro submits a coefficient value that reflects TLAP values for MISO's use in posting ATC on the MISO OASIS.

Manitoba Hydro establishes seasonal TTCs for each of the interfaces. These TTC's will remain the same through the season. MISO will establish hourly TRM to determine the SOL's for short term transmission services.

4.1 Manitoba-USA Interface

The Manitoba - USA interface consists of four tie lines, namely:

- D602F, a 500 kV line from Dorsey, MB to Forbes, MN. This 500 kV line has a continuous capability of carrying 1732 MVA.
- L20D, a 230 kV line from Letellier, MB to Drayton, ND. This 230 kV line has a continuous capability of carrying 420 MVA in summer and 470 MVA in winter.
- G82R, a 230 kV line from Glenboro, MB to Rugby, ND. This 230 kV line has a continuous capability of carrying 335 MVA.
- R50M, a 230 kV line from Richer South, MB to Moranville, MN. This line has a continuous capability of carrying 230 MVA.

Although each line has the capability listed above, the interface capability is not equal to the sum of the individual line's capability. Manitoba Hydro owns 100% of the Canadian facilities that make up this interface, and therefore does not require a process to allocate transfer capability across lines or owners.

4.1.1 General Analysis

Limits are determined by steady state and post-contingency load flow, transient stability and voltage stability analyses. All test load flows are subjected to single and key multiple element outages of all major transmission elements in the northern USA network near Manitoba and in southern Manitoba.

4.1.2 Network Parameter Modeling for Loadflow/Stability Studies

NMORWG has prepared and periodically updates study packages of base load flows, transient stability databases and related programs and database files for conducting network studies in northern MAPP areas, including Manitoba Hydro. Databases include files to apply single and multiple element contingency outages on load flow models for all analysis categories, based on agreement of NMORWG members and concerned associates on which outages throughout northern MAPP area require analysis to properly define transfer capabilities.

NMORWG obtains initial updated base load flow models with intact transmission network configurations for MH, Saskatchewan, Ontario and USA from MAPP data submissions. These models are further modified to interface with databases that accommodate special northern MAPP area network models and operating considerations, and then included in the NMORWG study packages.

MAPP and NMORWG base load flows are developed at seasonal peak load levels, and at off-peak load levels of 90% winter peak and 85% summer peak. A 70% summer peak is also compiled to examine feasible conditions of high transfer capabilities at low network load levels.

Generation adjustments in load flows are controlled by an NMORWG studies support program, which alters generation throughout the MRO network in pre-defined patterns to adjust key interface transfers to desired levels for analysis. MH AC generation is normally represented in base load flows based on economic dispatch and coordinated with the amount of MH load being modeled, and required variances in MH-USA transfers are balanced by HVDC output adjustments at Dorsey.

Transfer limits are also determined for all “key outage” configurations (both single and selected multiple element) that impact transfer capability of the interface.

Transfer dependencies are accounted for in calculation of TTC for the MH-USA interface. Studies account for various inter-dependency of transfers in the NMORWG region. These interchange schedules include NDEX, B10T, F3M, MH-Ontario, MWEX, and other MAPP interfaces. The MH-USA TTC is calculated as a function of NDEX, which is the most sensitive interface to MHEX. The other interface schedules are set at the levels that are most restrictive to MHEX.

4.1.3 **Analysis Criteria**

Types of limiting criteria on network facilities which are used to determine transfer limits in required analyses are:

- low and high station bus voltages
- overloaded transmission lines and networking transformers
- transmission line out-of-step relay blinder margins during transient disturbances (ie: how close line is to tripping by out-of-step swing condition)
- protective relay operations for exceeded network parameter settings
- transient disturbance power swing oscillation damping ratios
- voltage stability limits
- reactive power reserve at Dorsey

4.1.4 **Transfer Capability Tables**

Transfer capabilities are captured by TLAP tables which outline the sensitivities of transfer values to variances in key network parameters and conditions. This ensures operating interface transfers reliably for all varying network conditions, plus maximizing transfer levels under favourable conditions.

4.1.5 **Miscellaneous**

Maximum allowed MH-USA interface transfer capabilities are limited to values less than analyzed maximum capabilities by USA Presidential Permits and NEB permits. For the highest probability operating conditions, the lowest “firm” transfer capability is determined, and reliability margins equal to the difference between the “firm” limit and the Presidential Permit limit are applied.

4.1.6 **Contingencies**

The post disturbance (PD) analysis as implemented in pd.ipl is used to study the system performance in 5 to 10 minute time frame following a disturbance. With post disturbance analysis, only automatically controlled devices, such as switched capacitors and reactors and transformer tap changers, are allowed to regulate while manual system adjustment is not considered. Phase shifting transformer tap control and HV dc reduction schemes are appropriately modeled.

The post disturbance voltage and loading criteria are examined for the following disturbances.

mat	Trip of Dorsey to Forbes 500 kV line – D602F
emt	Trip of Letellier to Drayton 230 kV line – L20D
mct	Trip of Richer to Moranville 230kV line – R50M
mdt	Trip of Glenboro to Rugby 230 kV line – G82R
btt .	Trip of Boundary Dam to Tioga 230 kV line – B10T

btt-s	Trip of Boundary Dam to Tioga 230 kV line – B10T and cross trip one Boundary Dam unit (for MHEX_S only)
nbt	Trip of Dorsey to Forbes to Chisago 500 kV lines – D602F and F601C (for MHEX_S only)
ndt	revised *nbt* without cross trip of D602F (for D602F out of service only)
nct.	Trip of Forbes to Chisago 500 kV lines – F601C (for MHEX_N only)
mud	Trip of Mud Lake to Benton 230 kV line (for F601C prior outage only)
black	Trip of Blackberry to Riverton 230 kV line with 300 MW generation reduction at Boswell (for F601C prior outage only)
bear	Trip of Arrowhead to Bear Creek 230 kV line with 300 MW generation reduction at Boswell (for F601C prior outage only)
ahd-slk	Trip of Arrowhead to Stone Lake 345 kV line
forbes1	Trip of Forbes to Blackberry 230 kV line
forbes	Trip of Forbes to Arrowhead 230 kV line

The following are the additional Manitoba internal disturbances used in post disturbance analysis.

s53g	Trip of St. Leon to Glenboro 230 kV line – S53G
g37c	Trip of Glenboro to Cornwallis 230 kV line – G37C
y51l	Trip of LaVerendrye to Letellier 230 kV line – Y51L
s60la	Trip of St. Leon to Stanley section of the 230 kV line – S60L
s60lb	Trip of Letellier to Stanley section of the 230 kV line – S60L
d14s	Trip of Dorsey to St. Leon 230 kV line – D14S

Faults *s60la, s60lb, and y51L* will initiate HVdc reduction.

4.2 **Manitoba-Ontario Interface**

The Manitoba - Ontario Interface is made up of two 230 kV ties, K21W and K22W, from Whiteshell, MB to Kenora, ON. These two lines are controlled with two 115 kV phase-shifters, one on each 230 kV tie. Each of these lines has 190 MW of continuous capability in winter and 163 MW of continuous capability in summer. Although each line has the capability listed above, the interface capability is not equal to the sum of the individual line's capability. Manitoba Hydro owns 100% of the Manitoba facilities that make up this interface, and therefore does not require a process to allocate transfer capability across lines or owners.

Manitoba Hydro does not have any contractual obligations for allocation of TTC.

Manitoba Hydro - Ontario Hydro One interface transfer capability is determined from separate analyses conducted by Manitoba Hydro System Performance department and by Ontario Independent Electricity System Operator (IESO), and is also coordinated with the latest analysis and guides from the Manitoba-Ontario-Minnesota (MOM) interconnect working group.

Transfer for Ontario is dependent on Winnipeg River Generation levels. For winter, transfer limits are posted according to three generation patterns; for summer, transfer limits are posted according to four generation patterns. There is no reserve sharing requirement for the Ontario interface. There is a 25 MW dead-band on the Ontario interface due to the two phase shifters, which forms part of the TRM.

4.2.1 General Analysis

Limits are determined by steady state and post-contingency load flow analysis. All test load flows are subjected to single element outages of all major transmission network facilities (i.e.: one line, one network transformer, one generator) in north-western Ontario and in eastern Manitoba. (N.B. – MH network outages of major elements north and west of Dorsey 230 kV station have very little effect on MH-Ontario transfers due to the massive anchoring/modulating effect of the Dorsey HVDC system, so these lines are not included in MH-Ontario contingency analysis)

MH studies Manitoba system limits to the Manitoba border. IESO studies IESO system limits to the MH-Ontario border. MOM is the only group that actually does joint studies on the MH-IESO-MP interface. The lowest of the three numbers are used for transfer limits

Note: Analysis conducted by the MOM working group includes transient stability and partial voltage stability analysis to qualify MH-Ontario transfer capabilities.

4.2.2 Network Parameter Modeling for Loadflow/Stability Studies

Base load flow models with intact transmission network configurations for MH, SP, Ontario and USA are derived from the latest seasonal base model packages available from NMORWG and/or MAPP. All MH and Ontario area transmission facility additions and adjustments scheduled for installation during the examined study period are added to the base models.

Jointly prepared models are only used for MOM studies. IESO uses their own models for their studies (see comment above). Ontario area transmission is not changed in models used by MH for MH-IESO limits unless the models are part of a joint study.

For MH conducted studies, base load flows are developed at summer peak load and winter off-peak (90%) load. Test load flow cases are developed for four levels of Winnipeg River generation, from highest generation capability to lowest historical generation. Cases are also developed for two levels of generation at Selkirk Generating Station, one and two units on-line. Due to Dorsey HVDC, other sources of generation in Manitoba have little or no effect on Manitoba - Ontario transfer. The remainder of Manitoba generation is set to serve load and USA export requirements and to maintain consistent USA exports while determining Manitoba - Ontario transfer capability.

Note: Analysis conducted by the MOM working group or by Ontario IESO includes considerable adjustment of north-west Ontario loads, due to sensitivity of Ontario area transfer limiting factor values to load variances. MH area limiting factor values are not significantly affected by eastern MH load variances.

Transfer limits are also determined for all "key outage" configurations (both single and selected multiple element) that impact the transfer capability of the interface.

4.2.3 Analysis Criteria

Types of limiting criteria on network facilities which are used to determine transfer limits in steady state and post-contingency load flow analysis are:

- change in voltage
- low station bus voltages
- overloaded transmission lines and networking transformers
- reactive power margin at Seven Sisters

4.2.4 Transfer Capability Tables

Transfer capabilities are defined by tables derived from analysis results. The TLAP tables outline the sensitivities of transfer values to variances in key network parameters and conditions. This ensures operating interface transfers reliably for all varying network conditions, plus maximizing transfer levels under favourable conditions.

4.2.5 Miscellaneous

For posting purposes, MH-ONT transfer capabilities are qualified by the lowest studied transfer capability values for specific network configurations derived from the latest Manitoba Hydro, Ontario IESO and MOM study guides and/or reports.

4.2.6 Contingencies

'TD2'	- Trips Transcona to Dawson Rd 66kv line
'TD3'	- Trips Transcona to Atwood 66kv line
'TA11'	- Trips Transcona to Shell Oil 66kv line
'CR2 '	- Trips Parkdale to Rosser 115kv line
'CR4 '	- Trips Parkdale to Rosser 115kv line
'GP1'	- Trips Great Falls to Pine Falls 115kv line
'GS21'	- Trips Great Falls to Selkirk 115kv line 1
'GS22'	- Trips Great Falls to Selkirk 115kv line 2
'SG12'	- Trips Great Falls to Seven Sisters 115kv line
'HS5 '	- Trips Harrow to Scotland 115kv line
'K21W '	- Trips Kenora to Whiteshell 230kv line
'KY32_RK6'	- Trips Rosser to Kirkfield - Kirkfield to Laverendrye 115kv line

'MC28'	- Trips Mercy to Parkdale 115kv line
'PC3'	- Trips Parkdale to Pine Falls 115kv line
'PC4'	- Trips Parkdale to Pine Falls 115kv line
'PR2 '	- Trips Pine Falls to McArthur Falls 115kv line
'RL1'	- Trips Rosser to McPhillips 115kv line 1
'RL2 '	- Trips Rosser to McPhillips 115kv line 2
'RL3 '	- Trips Rosser to McPhillips 115kv line 3
'RL4 '	- Trips Rosser to McPhillips 115kv line 4
'RS51'	- Trips Rosser to St. James 115kv line
'RY7'	- Trips Rosser to Laverendrye 115kv line
'SC25'	- Trips Parkdale to Selkirk 115kv line
'SM26'	- Trips Selkirk to Mercy 115kv line
'TS44'	- Trips Transcona to Selkirk 115kv line
'SR3+SW3-3TRM'	- Trips Seven Sisters to McArthur Falls - Seven Sisters to Whiteshell 115kv line
'ST5 '	- Trips Seven Sisters to Transcona 115kv line
'ST6'	- Trips Seven Sisters to Transcona 115kv line
'ST6VivBK1oos'	- Trips Vivian to Transcona 115kv line
'SV24'	- Trips St. Vital to Selkirk 115kv line
'SW1 '	- Trips Seven Sisters to Whiteshell 115kv line 1
'SW2 '	- Trips Seven Sisters to Whiteshell 115kv line 2
'SW4'	- Trips Seven Sisters to Whiteshell 115kv line 4
'TR5'	- Trips Transcona to Rosser 115kv line
'TV1 '	- Trips Transcona to St. Vital 115kv line 1
'TV2 '	- Trips Transcona to St. Vital 115kv line 2
'VH1'	- Trips St. Vital to Harrow 115kv line
'VS27_SCOTPS'	- Trips St. Vital to Scotland 115kv line
'VP35'	- Trips St. Vital to Plessis Rd 115kv line
'TP65'	- Trips Transcona to Plessis Rd 115kv line
'WT34'	- Trips Whiteshell to Transcona 115kv line
'XH46'	- Trips Mohawk to Harrow 115kv line
'XV39'	- Trips Mohawk to St. Vital 115kv line
'YH33'	- Trips Laverendrye to Harrow 115kv line
'McPh BK8'	- Trips McPhillips 115kv Bank 8
'YV5-3TERM'	- Trips Laverendrye to St. Vital 115kv line
'YX47-3TERM'	- Trips Laverendrye to Mohawk 115kv line
'K22W'	- Trips Kenora to Whiteshell 230kv line
'D72V'	- Trips Dorsey to St. vital 230kv line
'D5R'	- Trips Dorsey to Rosser 230kv line
'D13R'	- Trips Dorsey to Rosser 230kv line

'D16R'	- Trips Dorsey to Rosser 230kv line
'D36R'	- Trips Dorsey to Ridgeway 230kv line
'R23R'	- Trips Rosser to Ridgeway 230kv line
'D55Y'	- Trips Dorsey to Laverendrye 230kv line
‘D11Y'	- Trips Dorsey to Laverendrye 230kv line
‘D15Y'	- Trips Dorsey to Laverendrye 230kv line
‘R32V'	- Trips Ridgeway to St. vital 230kv line
‘R33V'	- Trips Ridgeway to St. vital 230kv line
‘D72V+D36R'	- Trips Dorsey to St. vital 230kv line and Dorsey to Ridgeway 230kv line
‘D13R+D16R'	- Trips two (2) Dorsey to Rosser 230kv lines
‘R23R+D36R'	- Trips Rosser to Ridgeway 230kv line and Dorsey to Ridgeway 230kv line
‘D55Y+D15Y'	- Trips two (2) Dorsey to Laverendrye 230kv lines
‘D15Y+D11Y'	- Trips two (2) Dorsey to Laverendrye 230kv lines
‘R32V+D72V'	- Trips Ridgeway to St. Vital 230kv line and Dorsey to St. Vital 230kv line
‘K21W+K22W'	- Trips two (2) Kenora to Whiteshell 230kv lines
‘CR4+TR5'	- Trips Parkdale to Rosser 115kv line and Transcona to Rosser 115kv line
‘GS21+GS22'	- Trips two (2) Great Falls to Selkirk 115kv lines
‘GP1+PR2'	- Trips Great Falls to Pine Falls 115kv line and Pine Falls to McArthur Falls 115kv line
‘SG12+PR2'	-Trips Seven Sisters to Great Falls 115kv line and Pine Falls to McArthur Falls 115kv line
‘SG12+SR3'	-Trips Seven Sisters to Great Falls 115kv line and Seven Sisters to McArthur Falls 115kv line
‘KY32+RY7'	- Trips Kirkfield to Laverendrye 115kv line and Rosser to Laverendrye 115kv line
‘MC28+SC25'	- Trips Mercy to Parkdale 115kv line and Parkdale to Selkirk 115kv line
‘PC3+PC4'	- Trips two (2) Parkdale to Pine Falls 115kv lines
‘PR2+SR3/SW3'	- Trips Pine Falls to McArthur Falls 115kv line and Seven Sisters to McArthur Falls - Seven Sisters to Whiteshell 115kv line
‘RL1+RL2'	- Trips two (2) Rosser to McPhillips 115kv lines
‘SC25+SM26'	- Trips Parkdale to Selkirk 115kv line and Selkirk to Mercy 115kv line
‘ST5+ST6'	- Trips two (2) Seven Sisters to Transcona 115kv lines

‘TS44+SV24'	- Trips Transcona to Selkirk 115kv line and St. Vital to Selkirk 115kv line
‘VP35+SV24'	- Trips St. Vital to Plessis Rd 115kv lin and St. Vital to Selkirk 115kv line
‘SW1+SW4'	- Trips two (2) Seven Sisters to Whiteshell 115kv lines
‘SW2+SW3/SR3'	- Trips Seven Sisters to Whiteshell 115kv line 2 and Seven Sisters to McArthur Falls - Seven Sisters to Whiteshell 115kv line
‘TV1+TV2'	- Trips two (2) Transcona to St. Vital 115kv lines
‘VH1+VS27'	- Trips St. Vital to Harrow 115kv line and St. Vital to Scotland 115kv line
‘XV39+YV5'	- Trips Mohawk to St. Vital 115kv line and Laverendrye to St. Vital 115kv line
‘YH33+YV5'	- Trips Laverendrye to Harrow 115kv line and Laverendrye to St. Vital 115kv line
‘YX48+YX47'	- Trips two (2) Laverendrye to Mohawk 115kv lines

4.3 **Manitoba-Saskatchewan Interface**

The Manitoba Saskatchewan interface is made up of three 230 kV lines, namely:

- P52E from the Pas, MB to EB Campbell, SK (a hydro generating facility in Saskatchewan). This line is capable of carrying 287 MVA in summer and 414 MVA in winter.
- R25Y from Roblin, MB to Yorkton, SK. This line is capable of carrying 228 MVA in summer and 414 MVA in winter.
- R7B from Reston, MB to Boundary Dam, SK (a coal fired generating station in Saskatchewan). This line is tapped at Auburton, SK to supply load. This line is capable of carrying 284 MVA in summer and 440 MVA in winter.

Although each line has the capability listed above, the interface capability is not equal to the sum of the individual line’s capability. Manitoba Hydro owns 100% of the Manitoban facilities that make up this interface, and therefore does not require a process to allocate transfer capability across lines, or owners.

Manitoba Hydro does not have any contractual obligations for allocation of TTC.

Manitoba Hydro – SaskPower (MH-SP) interconnecting tie line transfer limits are developed through joint studies of the System Performance departments of the two utilities on a semi-annual (winter and summer season) basis. The relatively wide geographical separation of the three 230 kV networking tie lines between the two utilities, plus significant differences in the network facility configurations on each end of the three tie lines, result in considerable variances in tie line interface transfer capabilities over the wide ranges of simultaneous load and generation

patterns feasible under normal circumstances. Analyses are conducted which determine interface transfer capabilities for the most probable operating configurations, and also examine sensitivities of the transfer capabilities to variances in major network parameters on both sides of the interface.

Manitoba Hydro posting for Saskatchewan transfers is characterized by complex algorithms that adjust ATC for varying load and generation configurations.

4.3.1 General Analysis

Limits are basically determined by post-contingency load flow analysis. All test load flows are subjected to single element outages of all major transmission network facilities (ie: one line, one network transformer, one generator) in SP and in the western area of MH closest to Saskatchewan.

(Note – MH network outages of major elements south and east of Dorsey and Cornwallis 230 kV stations have very little effect on MH-SP transfers due to the massive anchoring/modulating effect of the Dorsey HVDC system, so these elements are not included in MH-SP contingency analysis)

A partial voltage stability analysis is also performed on post-contingency solved cases to further qualify acceptable transfer limit values. When a maximum acceptable transfer limit has been determined for a particular network configuration, a related test load flow case with a criteria-determined transfer level higher than the accepted limit is also analyzed. Although normal facility limiting criteria will definitely be violated when the worst single element outages are applied to this case, if the test case is still convergent for all outages, voltage stability is deemed to be proven for the maximum acceptable transfer limit case.

In past studies, transient stability analysis of post-contingency maximum acceptable transfer limit load flow cases indicated no unacceptable system transient responses to worst contingency outages. Thus, transient stability analysis is not presently used for MH-SP transfer limit studies.

4.3.2 Network Parameter Modeling for Loadflow/Stability Studies

Base load flow models with intact transmission network configurations for MH, SP, Ontario and USA are derived from the latest seasonal base model packages available from NMORWG and/or MAPP. All MH and SP area transmission facility additions and adjustments scheduled for installation during the examined study period are added to the base models.

Base load flows are developed with SP area configurations ranging from minimum seasonal load to forecasted seasonal peak load in 200 MW steps. MH loads are adjusted to match the SP steps, based on latest records of coincident MH-SP load levels. Records comparing MH western network load to SP load are also compiled, to conduct sensitivity analyses of MH-SP transfer to the full range of possible MH western load levels in test case load flows.

For each 200 MW SP load step, the most probable SP generation patterns are incorporated into each base load flow. For the MH western area where hydro generation from only three station sources will affect MH-SP transfers, base cases are developed with minimum western MH

generation for west flow transfer (maximum generation for east transfer) to first determine minimum initial MH-SP transfer capabilities. All western MH and SP generation is then adjusted as necessary for generation change sensitivity analysis, from minimum to maximum feasible generated power at each generation source. The remainder of Manitoba generation is set to serve load and USA export requirements and to maintain consistent USA exports while determining MH-SP transfer capability.

Transfer limits are also determined for all "key outage" configurations (both single and selected multiple element) that impact transfer capability of the interface.

4.3.3 **Analysis Criteria**

Types of limiting criteria on network facilities which are used to determine transfer limits in post-contingency load flow analysis are:

- low station bus voltages
- overloaded transmission lines and networking transformers
- reactive power overloading on generators not equipped with automatic thermal overload control devices
- voltage stability at pre-determined transfer level above maximum level obtained from other criteria above, qualified by converged test load flows for all contingency outages applied to higher transfer level

4.3.4 **Transfer Capability Tables**

Transfer capabilities are defined by formulae and tables derived from analysis results and are reflected in the TLAP tables. The formulae and tables outline the sensitivities of transfer values to variances in key network parameters and conditions. This ensures operating interface transfers reliably for all varying network conditions, plus maximizing transfer levels under favourable conditions.

4.3.5 **Miscellaneous**

For study cases with system intact at varying load and generation patterns, maximum transfer limits qualified by exceeded limits on SP facilities are reduced by 50 MW for SaskPower OASIS posting purposes in the MH-SP Operating Guides to reflect uncertainty in projected SaskPower BES conditions. Maximum transfer limits qualified by exceeded limits on MH facilities are reduced by 25 MW for Manitoba Hydro OASIS posting purposes in the MH-SP Operating Guides to reflect uncertainty in projected Manitoba Hydro BES conditions. The reason why there are two different TRM's is that Manitoba network parameter variances that affect transfer limits are less complex and easier to monitor than Saskatchewan parameters, hence requiring a smaller reliability margin.

4.3.6 Contingencies

Experience has indicated the contingencies listed below to be the worst outages for limiting transfers. During routine analysis other potential outages in MH and SP are tested to confirm that the specified outages are still the worst. When transfer limits are finally determined for the experienced "worst" outages, ALL feasible line and generator outages in MH and SP are tested on the load flows that provided the selected transfer limits to confirm limit acceptability.

- P2A-PR2 contingency (Poplar River to Assiniboine 230 kV line plus x-trip of fully loaded Poplar River Generating unit #2 of about 315 MW to prevent transient instability)
- PR2 contingency (trip-out of one Poplar River generating unit)
- Trip of B10T (SP to USA 230 kV tie line Boundary Dam to Tioga or BD Phase Shifting transformer) under heavy flow south
- Trip of R7B (Boundary Dam to Reston 230 kV tie line)
- Trip of C28R (Cornwallis to Reston 230 kV line)
- Trip of G1A or G2A (Grand Rapids to Ashern 230 kV line) under heavy northern AC generation
- Trip of P52E (The Pas to EB Campbell 230 kV tie line)

5 Existing Transmission Commitments (ETCs)

The firm ETC for Manitoba Hydro is defined by the following formula:

$$ETC_F = NITS_F + GF_F + PTP_F + ROR_F + OS_F$$

Where:

$NITS_F$ is the firm capacity set aside for Network Integration Transmission Service (including the capacity used to serve bundled load within the Transmission Service Provider's area with external sources) on ATC Paths that serve as interfaces with other Balancing Authorities.

GF_F is the firm capacity set aside for Grandfathered Firm Transmission Service and contracts for energy and/or Transmission Service, where executed prior to the effective date of a Transmission Service Provider's Open Access Transmission Tariff or safe harbor tariff on ATC Paths that serve as interfaces with other Balancing Authorities.

PTP_F is the firm capacity reserved for confirmed Point-to-Point Transmission Service.

ROR_F is the capacity reserved for roll-over rights for Firm Transmission Service contracts granting Transmission Customers the right of first refusal to take or continue to take Transmission Service when the Transmission Customer's Transmission Service contract expires or is eligible for renewal.

OS_F is the firm capacity reserved for any other service(s), contract(s), or agreement(s) not specified above using Firm Transmission Service, including other firm adjustments to reflect

impacts from other ATC Paths of the Transmission Service Provider. Manitoba Hydro does not use $\mathbf{OS_F}$.

The non-firm ETC for Manitoba Hydro is defined by the following formula:

$$ETC_{NF} = NITS_{NF} + GF_{NF} + PTP_{NF} + OS_{NF}$$

Where:

$\mathbf{NITS_{NF}}$ is the non-firm capacity set aside for Network Integration Transmission Service (i.e. secondary service, including the capacity used to serve bundled load within the Transmission Service Provider's area with external sources) on ATC Paths that serve as interfaces with other Balancing Authorities.

$\mathbf{GF_{NF}}$ is the non-firm capacity set aside for Grandfathered Non-Firm Transmission Service and contracts for energy and/or Transmission Service, where executed prior to the effective date of a Transmission Service Provider's Open Access Transmission Tariff or safe harbor tariff on ATC Paths that serve as interfaces with other Balancing Authorities. Manitoba Hydro does not use $\mathbf{GF_{NF}}$.

$\mathbf{PTP_{NF}}$ is the non-firm capacity reserved for confirmed Point-to-Point Transmission Service.

$\mathbf{OS_{NF}}$ is the firm capacity reserved for any other service(s), contract(s), or agreement(s) not specified above using Firm Transmission Service, including other firm adjustments to reflect impacts from other ATC Paths of the Transmission Service Provider. Manitoba Hydro does not use $\mathbf{OS_{NF}}$.

5.1 Transmission Service Requests Approval

- Requests < 1 year approved by MISO
- Requests > 1 year require both MHEB and MISO approval

MHEB OATT Business Practices section 5.7 identify formulas for release of firm and non-firm transmission service.

The Midwest ISO has developed an automated process to calculate the ATC on the Manitoba Hydro interfaces (MHEX, ONT, and SPC) called the "Manitoba Hydro Interface ATC Tool". The link to the Manitoba Hydro Interface ATC Tool is posted on the Midwest ISO OASIS home page under System Information & Studies and is entitled Manitoba Hydro Interface ATC Tool.

The Queries begin at 15 minutes past the hour and are posted on OASIS at 23 minutes past the hour. It is the responsibility of the tariff administrator on shift to manually track the sale of transmission service between hourly queries to ensure that transmission is not over sold. The tool is not a dynamic tool and the ATC posted on OASIS may contain information that is up to one hour old. The Midwest ISO Tariff Administration staff use the ATCs calculated by most

recent update to sell transmission service. Transmission Service sold during the interval between updates is not reflected on OASIS.[1]

6 Available Transfer Capacity (ATC)

Manitoba Hydro posts its tie line Available Transfer Capability (ATC) on the MISO oasis page: http://oasis.midwestiso.org/documents/mheb/mheb.asp

6.1 Defining the Interfaces[2]

6.1.1 Manitoba - USA interface:

The Manitoba - USA interface is made up of 4 transmission lines:

- D602F - 500kV line from Dorsey Station to Forbes Station
- L20D - 230 kV line from Letellier Station to Drayton Station
- R50M - 230 kV line from Richer South Station to Moranville Station
- G82R - 230 kV line from Glenboro South Station to Rugby Station

The flows on these four lines have been "netted" in the past and form the MHEX interface. Historically, the interface has been split into three parts, MHEX, MHEX-MISO and MHEX-MAPP. MHEX is the total interface and is used by the Manitoba Hydro Control Centre and the MISO RC to control flows in real time. The MHEX-MISO portion has values for south flow (Exports into MISO) and for north flow (Imports into Manitoba), while the MHEX-MAPP has only the south flow portion. The MISO and MAPP Portion is used as Allocations for selling firm transmission service and at the same time honoring their share of the interface historically. The Manitoba – USA interface is modeled in either direction depending upon the flow such as MHEX_N (Flow into MHEB) or MHEX_S (Flow into USA).

The inputs into the ATC tool based upon the seasonal studies for this interface are as follows:

TTC:	Total Transfer Capability
RM:	Reliability Margin - Non recallable
CRSG:	Midwest Contingency Reserve Sharing Group
OM:	Operating Margin - includes deadband, losses & recallable portion
TRM:	Total Reliability Margin
Transfer Limit:	Maximum flows measured at the stations
Firm Scheduling limit:	Amount of firm that can be transacted at the MH-USA border
Dynamic Schedule:	Total of firm & non-firm transacted at the MH-USA border

[1] From 5.7 of the MHEB OATT Business Practices

[2] Section 6.1 is copied directly from section 2. Interface Descriptions of the **MHEB Interface ATC tool_revised_20110531.docx**

The TRM used for firm and Non- Firm is sometimes different due to the adjustments that was agreed in the MH - USA coordination committee meeting to prevent the selling of Firm transmission service on this interface until the studies on the interface are finalized. It is important to note that the scheduling limits are posted at the MH-USA border (where the energy transfer takes place) and the transfer limits are measured at the four Manitoba stations (where the metering values are available). There can be up to 50 MW of difference between these two values to cover the losses inside Manitoba.

Under system intact conditions, the Operating Margin is made up of 25 MW to cover the Ontario phase shifter bandwidth, 50 MW for Manitoba losses and 0 recallable. The Manitoba-Ontario is a controlled interface with a phase shifter bandwidth of +/- 25 MW. This bandwidth is added to the TRM on the MH-USA interface to cover cases where the Manitoba-Ontario flows are at the lower end of the bandwidth, thus under-delivering to the east and over-delivering to the south.

Prior to the development of MISO, MHEB, NSP, MP, OTP & MPC controlled the MHEX interface. When MISO was created, all entities but MPC joined and the MHEX-MAPP interface was created to allow MH-MPC transactions to continue using MAPP schedule F. With the Seams agreement between MHEB and MISO, MISO took over the responsibility of administering the postings of MHEX using the ATC tool described in this document.

In addition to the system intact values, prior outage values are provided for all of the following elements associated with the MHEX interface:

Tie Lines and Internal Manitoba Hydro lines:

D602F – Dorsey to Forbes	L20D – Letellier to Drayton
R50M – Richer to Moranville	G82R – Glenboro to Rugby
Dorsey 230/500kV Bank	D14S – Dorsey to St Leon
G37C – Glenboro to Cornwallis	R49R – Ridgeway to Richer
S53G – St Leon to Glenboro	S60L – St Leon to Letellier
Y51L – Laverendrye to Letellier	

Multiple line outages:

D602F & 601 – Dorsey to Chisago	D602F & L20D
D602F & R50M	D602F & G82R
L20D & R50M	L20D & G82R
R50M & G82R	Double Outage (not 500 kV lines)

USA Transmission lines & equipment:

601 – Forbes to Chisago	B10T – Boundary Dam to Tioga
F3M – Ft Francis to International Falls	Balta – Harvey
Balta – McHenry	Balta – Ramsey
Balta to Rugby	Chisago to King

Chisago to Kolman	Drayton – Prairie
Falconer to Grand Forks	Grand Forks to Pickert
Jamestown to Pickert	Moranville to Running
Oslo to Thief River	Prairie – Grand Forks
Prairie – Ramsey	Running to Shannon (907L)
Chisago - One 500/345kV Bank	Chisago Series Cap Off
Forbes SVS	Forbes MSC Off
Roseau – One Series Cap Off	Roseau – Two Series Caps Off
Balta Switched Cap	Prairie Switching Caps
Roseau Switched Capacitor	Running Switched Capacitor
Arrowhead Weston	

The values for the above equipment are detailed in the spreadsheet (TLAP) that is used by the tool. The breakdown between Firm and Non-firm is reflected in the MHEB NOP 1102-02 Summer USA Export and Imports Limits and MHEB NOP 1102-01 Winter USA Export and Import Limits used by the Manitoba Hydro System Control Centre and the MISO Reliability Coordinator.

6.1.2 **Manitoba - Ontario interface:**

The Manitoba - Ontario interface is made up of 2 transmission lines:

- K21W - 230 kV line from Whiteshell Station to Kenora Station
- K22W - 230 kV line from Whiteshell Station to Kenora Station

Each of these lines have a phase shifter that controls the flows within the +/- 25 MW bandwidth. The inputs into the ATC tool based upon the seasonal studies for this interface are as follows:

TTC:	Total Transfer Capability
RM:	Reliability Margin - Non recallable
OM:	Operating Margin - includes deadband & recallable portion
TRM:	Total Reliability Margin
Transfer Limit:	Maximum flows measured at Whiteshell station
Firm Scheduling limit:	Amount of firm schedules
Dynamic Schedule:	Total of firm & non-firm schedules

These values are also determined by seasonal studies. The recallable portion of the OM is based against the generation at the 6 generating stations on the Winnipeg River. The current values have a low generation pattern with 205 to 300 MW, a medium generation pattern with 301 to 450 MW and a high generation pattern with 451 to 591 MW. The recallable portion is released to the

non-firm market 7 days in advance. Each night at midnight, the 7th day is released. Seven days is used because we have a good indication of water flows seven days in advance.

In addition to the two interface lines, the following equipment also affects the limits on the Manitoba Hydro side of the Manitoba-Ontario interface. Transmission lines inside Ontario are not included as they post the values on their side separately. The Manitoba posted values will restrict the amount of schedules available to the Ontario market and the Ontario values will limit the amount the market can accept. The lower value of the two sides will limit the transactions.

CR2 or CR4: Rosser to Parkdale
GP1: Great Falls to Pine Falls
GS21 or GS22: Great Falls to Selkirk
MC28: Parkdale to Mercy
PC3 or PC4: Parkdale to Pine Falls
PR2: Pine Falls to McArthur
SC25: Selkirk to Parkdale
SG12: Seven Sisters to Great Falls
SM26: Selkirk to Mercy
ST5 or ST6: Seven Sisters to Transcona
SV24: Selkirk to St. Vital
SW1 or SW2 or SW3/SR3 or SW4: Seven Sisters to Whiteshell
TP65: Plessis Road to Transcona
TR5: Transcona to Rosser
TS44: Selkirk to Transcona
TV1 or TV2: Transcona to St. Vital
VP35: St. Vital to Plessis Road
WT34: Whiteshell to Transcona
D11Y or D15Y or D55Y: Dorsey to Laverendrye
D13R or D16R or D5R: Dorsey to Rosser
D36R: Dorsey to Ridgeway
D72V: Dorsey to St. Vital
R23R: Rosser to Ridgeway
R32V or R33V: Ridgeway to St. Vital
Seven Sisters Generation at 4 Units

Multiple line outages:

K21W or K22W and D5R or D13R or D16R
K21W or K22W and any other critical outage
ANY TWO CRITICAL OUTAGES other than K21W OR K22W
K21W or K22W and any pair of critical outages

The values for the above equipment are detailed in the spreadsheet (TLAP) that is used by the tool. The breakdown between Firm and Non-firm is reflected in MHEB NOP 1102-05 MH-IESO Interface Summer Export and Import Limits and MHEB NOP 1102-03 MH-IESO Interface Winter Export and Import Limits used by the Manitoba Hydro System Control Centre and the MISO Reliability Coordinator. The Manitoba – Ontario interface is modeled in either direction depending upon the flow such as MH_ONT_W (Flow into MHEB) or MH_ONT_E (Flow from MHEB).

6.1.3 **Manitoba - Saskatchewan interface:**

The Manitoba - Saskatchewan interface is made up of 3 transmission lines:

- R7B - 230 kV line from Reston Station to Boundary Dam Station
- R25Y - 230 kV line from Roblin South Station to Yorkton Station
- P52E - 230 kV line from Ralls Island Station to E.B. Campbell Station

The inputs into the ATC tool based upon the seasonal studies for this interface are as follows:

TTC:	Total Transfer Capability
RM:	Reliability Margin - Non recallable
OM:	Operating Margin - includes recallable portion
TRM:	Total Reliability Margin
Transfer Limit:	Maximum flows measured at the stations
Firm Scheduling limit:	Amount of firm schedules
Dynamic Schedule:	Total of firm & non-firm schedules

These values are also determined by seasonal studies. The recallable portion of the OM is based against the load in the Northwest area of the province. For system intact calculations, generation patterns at Grand Rapids, power south of Ponton and import from Island Falls generating station are also used.

For all prior outages, only the load factor is used. The current values have 3 to 5 different load patterns dependant on which prior outage is in effect. For real-time, the default will be simply the firm value and then the recallable (hourly non-firm) will be released by shift staff based on the forecasted Northwest load. For all planned outages, the forecasted load will be used to determine which pattern best fits the forecasted conditions and recallable (hourly non-firm) will be released in advance. The recallable portion is released to the non-firm market 7 days in advance. Each night at midnight, the 7th day is released. Seven days is used because we have a good indication of water flows seven days in advance.

In addition to the three interface lines, the following equipment also affects the limits on the Manitoba Hydro side of the Manitoba-Saskatchewan interface. Transmission lines inside Saskatchewan are not included as they post the values on their side separately. The lower value of the two sides will limit the transactions.

A3R – Ashern to Rosser	A4D – Ashern to Dorsey
A6V – Ashern to Vermillion	C28R – Cornwallis to Reston
G1A or G2A – Grand Rapids to Ashern	G9F – Grand Rapids to Overflowing River
G31V – Grand Rapids to Vermillion	V57R – Vermillion to Roblin South
F27P – Overflowing River to Ralls Island	P18H – Ponton to Herblet Lake
H59C – Herblet Lake to Cliff Lake	P58C – Ralls Island to Cliff Lake
B69R - Birtle South to Raven Lake	B70H - Birtle South to Virden West
F10M - Overflowing River to Minitonas	M39V - Minitonas to Vermillion

R29H - Reston South to Virden West V38R - Vermillion to Raven Lake

The values for the above equipment are detailed in the spreadsheet (TLAP) that is used by the tool. The breakdown between Firm and Non-firm is reflected in the MHEB NOP 1102-07 SPC Summer Export and Import Limits and MHEB NOP 1102-06 SPC Winter Export and Import Limits used by the Manitoba Hydro System Control Centre and the MISO Reliability Coordinator. The Manitoba – Ontario interface is modeled in either direction depending upon the flow such as MH_SPC_W (Flow into SPC) or MH_SPC_E (Flow into MHEB).

6.2 General Principles and Assumptions of the Midwest ISO ATC tool[3]

This process includes the following assumptions and the rules that are used in determining the transfer capabilities across the interface and at the same used to determine the Allocation on MHEX flowgate.

1. Results from the Seasonal studies are used as an input to the ATC tool
2. The software includes all the outages that are active on the third Wednesday of the month and cover 50% of the peak hours i.e. 1000 HS to 2000 HS of the day
3. For Daily, the outages that are valid at 15 PM of the day are considered.
4. MISO Outage Scheduler is used to query the outages that are accepted for CA's such as WAUE, MHEB, OTP, SPC, GRE, NSP, MDU and MP that are thought to affect the transfer capabilities of the interfaces and affect the allocation on MHEX flowgate.
5. The outages in the Operating guide were mapped to IDC names (External names in the MISO outage scheduler)
6. Months May 1st to Nov 1st are considered as Summer and Nov 1st to May 1st are considered as Winter Months
7. MAPP and MISO are the only two reciprocating entities that will have an allocation on the MHEX flowgate. All other entities will have a zero allocation.
8. The allocation of MAPP and MISO on MHEX changes with season and system conditions.
9. Only Forward Allocation on MHEX flowgate is overwritten with the system intact values/Outage condition values. No changes were made to Reverse Allocation. These are further used to set the firm flow limits for MISO market flow reported to IDC.
10. For any day, if MISO and MAPP allocation becomes negative due to the outages on that day, then the software sets Allocation for that entity to zero accordingly

6.3 Posting of Firm and Non Firm ATC

For real time operations the values of TTC, TRM are implemented to ensure that the Transmission Provider does not implement assumptions no more limiting than those used in the planning of operations for the study period. This is achieved by implementing the TLAP tables into the MISO webtool. The TLAP tables are updated prior to the operating season (May 1 for summer operations, November 1, for winter operations).

[3] Section 6.2 is copied directly from section 3. General Principles and Assumptions of the **MHEB Interface ATC tool_revised_20110531.docx**

6.3.1 **Firm ATC**

$ATC_F = TTC – ETC_F – CBM – TRM + Postbacks_F + counterflows_F$

Where:

ATC_F is the firm Available Transfer Capability for the ATC Path for that period.

TTC is the Total Transfer Capability of the ATC Path for that period.

ETC_F is the sum of existing firm Transmission commitments for the ATC Path during that period. Manitoba Hydro's firm ETCs are the summation of firm reservation capacity.

CBM is the Capacity Benefit Margin, which is zero for Manitoba Hydro. Manitoba Hydro does not require CBM reservations to meet generation reliability requirements.

TRM is the Transmission Reliability Margin for the ATC Path during that period. For firm ATC calculations, Manitoba Hydro uses a Firm TRM as defined by the TRMID.

$Postbacks_F$ are changes to firm ATC due to a change in the use of Transmission Service for that period. Manitoba Hydro does not use **$Postbacks_F$**.

$counterflows_F$ are adjustments to firm ATC as determined by the Transmission Service Provider and specified in the ATCID. Manitoba Hydro does not use **$counterflows_F$**.

For all time points in the Midwest ISO time horizon:

$ATC_F = TTC – TRM_{FIRM} – (NITS_F + GF_F + PTP_F + ROR_F)$

6.3.2 **Non Firm ATC**

$ATC_{NF} = TTC – ETC_F - ETC_{NF} – CBM_S – TRM_U + Postbacks_{NF} + counterflows_N$

Where:

ATC_{NF} is the non-firm Available Transfer Capability for the ATC Path for that period.

TTC is the Total Transfer Capability of the ATC Path for that period.

ETC_F is the sum of existing firm Transmission commitments for the ATC Path during that period.

ETC_{NF} is the sum of existing non-firm Transmission commitments for the ATC Path during that period.

CBM_S is the Capacity Benefit Margin for the ATC Path that has been scheduled without a separate reservation during that period. CBM_S is zero for Manitoba Hydro. Manitoba Hydro does not require CBM reservations to meet generation reliability requirements.

TRM_U is the Transmission Reliability Margin for the ATC Path that has not been released for sale (unreleased) as non-firm capacity by the Transmission Service Provider during that period. In Manitoba Hydro's case, TRM_U=(Non Firm TRM)*COEF

$Postbacks_{NF}$ are changes to non-firm ATC due to a change in the use of Transmission Service for that period. Manitoba Hydro does not use **$Postbacks_{NF}$**.

$counterflows_{NF}$ are adjustments to non-firm ATC as determined by the Transmission Service Provider and specified in the ATCID. Manitoba Hydro does not use **$counterflows_{NF}$**.

Non-Firm ATC in Operating Horizon:

The Operating Horizon is the remainder of the day (day 1). If the time of day is later than 15:00, the operating horizon is extended to include tomorrow (day 2). During the operating horizon, the ATC calculation will release capacity from transmission reservations where schedules do not exist, as hourly non-firm ATC, with the exception being capacity from hourly non-firm reservations.

Non Firm ATC = TTC – (Non Firm TRM * COEF) – SCH_{TSR}

SCH_{TSR} = sum of $NITS_F$, GF_F, PTP_F schedules
- sum of monthly and daily non-firm schedules
- sum of hourly non-firm scheduled MW if available (if not scheduled upon, non-firm reservation MW are used).

Non-Firm ATC in the Planning Horizon:

The planning horizon is the period after the operating horizon, being:

- If the hour of the day is before 15:00, the planning horizon is tomorrow and beyond. or
- If the hour of the day is after 15:00, the planning horizon is day 3 and beyond.

During the planning horizon, the ATC calculation will only use transmission reservations MW values to calculate available non-firm ATC.

Non-Firm ATC = TTC – (TRM*COEF) – sum of firm reservations – sum of non-firm reservations

6.3.3 Prior Outage Scenarios

Manitoba Hydro calculates TTC and TRM for the prior outages of all internal and some external facilities that impact interface capability on a seasonal basis as described in 4.1 and 6.1 above. These capabilities are detailed in the TLAP tables for all three interfaces. Manitoba Hydro notifies MISO AFC Engineering a minimum of seven day in advance of revisions to operating guides for the MHEB, IESO or SPC interfaces that result in a change to TTC (Total

Transmission Capacity) or TRM (Transmission Reserve Margin) values under prior outage conditions. For planned outages, the MISO's Manitoba Interface ATC tool is programmed for prior outage conditions in accordance with the interface operating guide. Special studies are performed when multiple outages from other transmission service providers are expected and for which no previous off-line studies exist. If a special study is performed which changes the amount of TRM for a prior outage condition, Manitoba Hydro implements a manual override in MISO's Manitoba Interface ATC tool. In the absence of a special study, Manitoba Hydro updates the coefficient value to a conservative pre-determined limit that MISO uses for posting ATC. These reduced capabilities are used when that prior outage is in effect. For planned outages, daily and monthly ATC also reflect the reduction in transfer capability. As discussed below, generation and transmission information in the daily and monthly horizons are provided pursuant to the Seams Operating Agreement.

6.4 **Posting ATC**

Manitoba Hydro contracts the Midwest ISO (MISO) to administer its tariff and post its ATC on the interfaces[4]. For coordination purposes, the three interfaces are defined as flowgates, and their capability is defined using the ATC methodology defined herein.

To post ATC to sell transmission service, the MISO hosts an OASIS site on behalf of Manitoba Hydro. As per the Coordination Agreement5, Manitoba Hydro supplies the MISO with the TTC and a TRM coefficient. Manitoba Hydro also supplies the MISO with real-time and projected operating data pursuant to section 4.1 and 4.1.1 of the Seams Operating Agreement[6]. Such real-time and project operating data include real-time generation and transmission statuses and planned maintenance schedules for outages. The Midwest ISO has developed an ATC tool described in section 6.2.1 below to post ATC for Manitoba Hydro after processing the data supplied by Manitoba Hydro. Manitoba Hydro's Seams Operating Agreement also provides that MISO shall, on MH's behalf, provide operating data to neighbouring transmission owners.

According to the definition of Transmission Service Provider (TSP), the MISO is the TSP for Manitoba Hydro in the short term period because it is contracted to administer our tariff and to sell transmission service for periods less than one year. Manitoba Hydro is the TSP in the long term period because it processes requests for transmission service which are greater than one year in duration.

[4] Section 2.1.1 of the Amendment to the Coordination Agreement by and between Midwest Independent Transmission System Operator Inc and Manitoba Hydro: Issued October 13, 2009, effective January 1, 2010.
[5] Section 3.1 of the Amendment to the Coordination Agreement by and between Midwest Independent Transmission System Operator Inc and Manitoba Hydro: Issued October 13, 2009, effective January 1, 2010.
[6] Section 4.1 and 4.1.1 of the Seams Operating Agreement between the Midwest Independent Transmission System Operator Inc and Manitoba Hydro: Issued September 27, 2006, effective September 28, 2006

6.4.1 **Process Flow – ATC Tool**[6]

ATC Tool computes the transfer Flowgate capability and the available transfer Flowgate capability on the six interface flowgates using the results from the seasonal studies. The six interfaces include MHEX_N, MHEX_S, MH_SPC_E, MH_SPC_W, MH_ONT_W, and MH_ONT_E. The values are further used for selling transmission service for both firm and non-firm. Figure 1 below shows the overall system architecture of the ATC tool. The outage scheduler is used to query the outages that are active and used as an input to the TTC/TRM calculator. The inputs include the pre-populated system intact values and the system outage condition values and stored in a table called the TLAP tables. The inputs also include the coefficient factor that is provided by MHEB and used to calculate the releasable TRM. The TTC/TRM calculator processes the outage information and the inputs and determines the total transfer capability and reliability margins across the interfaces.

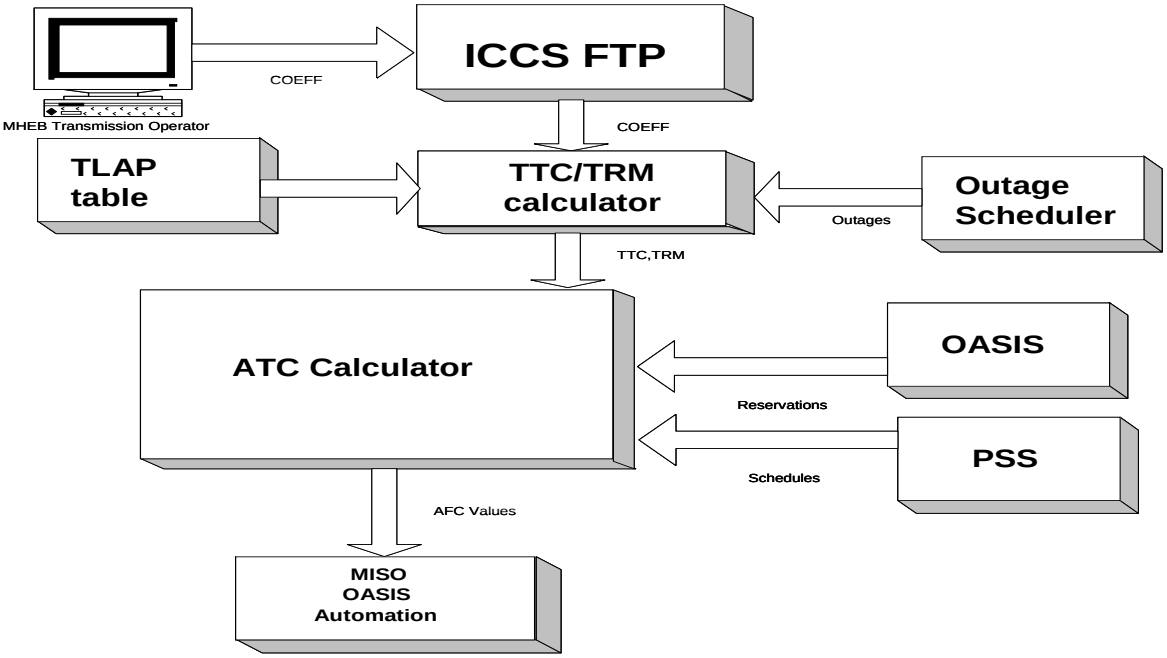

Figure 1. System Architecture of the ATC Tool

The TFC and the TRM values are further used by the ATC calculator to determine the available Flowgate capability across the interfaces using the reservations from the OASIS and the schedules from the MISO Physical scheduling system. The ATC values calculated are send to

[6] Section 6.4.1 is copied directly from section 4. Process Flow - ATC Tool of the **MHEB Interface ATC tool_revised_20110531.docx**

the OASIS Automation for further use in the TSR processing. The ATC values calculated are then send to the reciprocal entities that the Flowgate is reciprocal with using the standard ATC coordination process. The TTC/TRM calculator also calculates the MISO and MAPP portion of the MHEX_N and MHEX_S flowgates that are then used as allocations while selling firm transmission service. The allocations calculated are used to overwrite the historical allocations using the overwrite program that will be described in the later part of the document. The following is a more detailed description of the main components comprising the A:

1. Outage Scheduler: MISO outage scheduler is used to query the outages that affect the six interface flowgates. They include all categories of accepted outages that belong to the WAUE, MHEB, OTP, SPC, GRE, NSP, MDU and MP control areas. The output of the query is stored in a file that bears the name outage_yyyymmddhh.csv. The outages that are queried from the outage scheduler database are mapped to the PSSE external names in the TTC/TRM calculator program. All outages that are queried from the database are single outages, they are further processed by the TTC/TRM calculator program and classified into single, double, default double, triple and default triple outages. For a single outage, the TTC and TRM are directly read from the TLAP tables where as for double and triple outages a cross link table is used to determine the TTC and TRM values. In absence of a cross link table, the TLAP tables are used.

2. TTC/TRM Calculator:
   The inputs to the TTC/TRM calculator include

   a. TLAP tables: As discussed before, the system intact and the system outage condition values based upon the seasonal studies are pre-populated and stored in this file. This file is static and updated whenever new operating guides and studies were performed. Generally, the TLAP tables are updated every year in the month of April after the results were reviewed by the coordination committee. The TLAP tables for the MHEB – USA interfaces also include the MAPP and MISO shares for each system outage condition. The TLAP tables also contain information about the Hold back TRM and releasable TRM. While pre-populated the file, the outages were mapped to PSSE/SDX names. The format of the file is straight forward and understood easily. The TLAP tables also contain the break down of the TRM values such as CRSG, Operating Margin, reliability margin etc., for each system outage condition.
   b. Coefficient: The coefficient number is downloaded from the ftp site and is used to calculate releasable TRM. It is ratio of the system outage condition TRM to the System intact TRM. The coefficient is calculated every hour and extends upto 36 months into the future.

   The outputs to the TTC/TRM calculator include the TFC and TRM values for each interface for each point. They are outputted into a file that bears the following format for use by the ATC calculator.

Interface name, Balancing Authority, Type of data, TTC, NCBM, FCBM, Coefficient, Counter flow coefficient[7]*, NTRM,FTRM,NETC,RETC,Dependency,Time stamp, End of row.*

For e.g.

MHEX_MISO_S,	Interface for MHEX-MISO South
MHEB,	Manitoba Hydro BA
H,	Hourly data (also D - daily & M - Monthly)
2029,	TTC
0,	NCBM (Non Firm CBM and is no longer used)
0,	RCBM (Firm CBM and is no longer used)
1.0000,	Coefficient
0.0000,	Counter flow Coefficient
168,	Non Firm TRM
168,	Firm TRM
0,	RETC (no longer used)
N,	Dependency (normally No)
07/23/07 00:00:00,	Date Timestamp
A,	Trailer to indicate end of row

[7] Manitoba Hydro does not use counterflow, therefore this coefficient is set to zero.

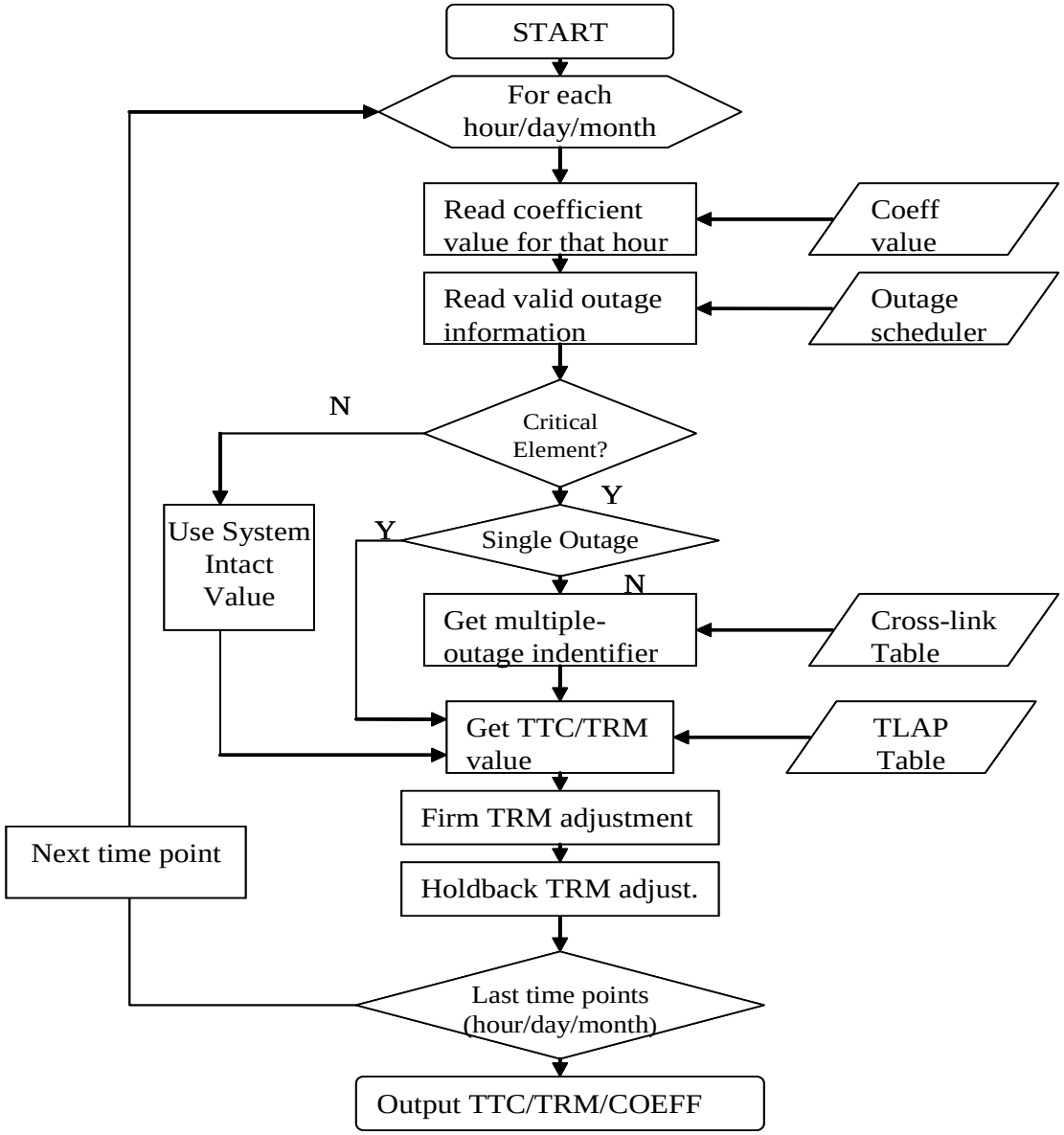

Figure 2. Process flow of the TTC/TRM calculator

3. ATC Calculator:

The inputs to the ATC calculator include the reservations and schedules that are active for that time point. The reservations are downloaded from the MHEB page from the MISO OASIS that affect each interface based upon the transaction path. They are downloaded each hour from the OASIS. During the scheduling horizon the reservations are replaced by the schedules from the MISO physical scheduling system that affect each interface. The reservations along with the TFC, TRM values are used by the ATC calculator as described below to determine the available transfer Flowgate capability for each interface. The

reservations taken care for any redirects that have taken place. The Output of the ATC Calculator includes the ATC values for the interface flowgates. The Firm ATC and Non-Firm are determined as follows for each of the interface:

Definitions:

- All times are in hour starting format, i.e. 00-23
- "Now" is defined as current MISO to time to the hour (EST time zone)
- Day 1 is "now" until end of now's day
- Day 2 is hour 0 through 23 of the day after day 1
- Capacity (MW) is always measured in absolute values.

Firm ATC:

For all time points in MISO time horizon:

Firm ATC = TTC – TRM – summation of firm reservation capacity

Non-Firm ATC:

If current hour < 1500

For time points now until end of day 1:

Non-Firm ATC = TTC – (TRM*COEF) – sum of all schedule capacity for time point if refers to firm reservation – sum of non-firm reservations, use scheduled MW if available, else using non-firm reservation MW

For all time points in day 2:

Non-Firm ATC = TTC – (TRM*COEF) – sum of firm reservations, use scheduled MW if available, else using firm reservation MW – sum of non-firm reservations, use scheduled MW if available, else using non-firm reservation MW

If current hour >= 1500

For time points now until end of day 1:

Non-Firm ATC = TTC – (TRM*COEF) – sum of schedule capacity for time point if refers to firm reservation – sum of non-firm reservations, use scheduled MW if available, else using non-firm reservation MW

For all time points in day 2:

Non-Firm ATC = TTC – (TRM*COEF) – sum of schedule capacity for time point if schedule refers to firm reservations – sum of non-firm reservations, use scheduled MW if available, else using non-firm reservation MW

For day3 and beyond, regardless of current hour

Non-Firm ATC = TTC – (TRM*COEF) – sum of firm reservations – sum of non-firm reservations

6.5 Scheduling[8]

The Manitoba Hydro Scheduling and interchange is controlled by the MHEB System Operator. The Operator uses an electronic scheduler that is driven by the interchange transaction system (E-Tag) specified by NERC. The electronic scheduler screens the tags and creates schedules for the three MHEB interfaces. It has several validations that it uses to ensure each tag follows the various rules for interchange specified by the Canadian Energy board and NERC.

7 Distribution of ATCID

This ATCID document, which describes existing practices at Manitoba Hydro, is posted on Manitoba Hydro's OASIS webpage:

http://oasis.midwestiso.org/OASIS/MHEB

An email notifying entities specified in R4 of NERC Standard MOD-001-1 will be sent to advise these entities of any future revisions to this ATCID document.

8 Data Retention for ATC Calculations

MISO retains component data (TTC, TRM, coeff, schedules, TSRs, MHEB override) for calculation of ATC in accordance with NERC requirements. Per request of MHEB, MISO can provide the archived data to MHEB.

[8] Refer to Section 10.0 Scheduling of the MHEB OATT Business Practices for more details.